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AN ANALYSIS OF THE RELATIONSHIPS BETWEEN PHORIA, BLUR, BREAK AND RECOVERY FINDINGS AT THE NEAR POINT*

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Purpose

This investigation was undertaken to analyze the relationships between phoria, blur, break, and recovery findings at 40 cm.

Procedure in Acquiring Data

One hundred cases were selected at random from the practice of Howard Haines, but included only those persons who had no difficulty to start with, or were satisfied with a new pair of glasses. No effort was made to control the subject's attitude in the recovery findings so that in analyzing the data it is not known whether the patient did all in his power to recover fusion. Furthermore, in the blur and break point tests the subjects were simply instructed to report when the blur and break points occurred and no intimation was given that they should keep the target clear or fused as long as possible.

Preliminary Considerations

In beginning the recovery test the power of the rotary prisms is increased beyond the break point. The eyes revert to the phoria position and a widely separated double image is seen. As the prism power is gradually reduced the separation of the images decreases, until finally the eyes make a movement to recover fusion. If the phoria, blur, break and recovery findings are represented on a prism scale as shown in Fig. 1, the range between the phoria and the base-in or base-out recovery

*An abridgment of the material presented before the American Academy of Optometry. For publication in the September, 1941 issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

point represents the range through which the eyes have to move in order to recover fusion.

The movement to recover fusion is often referred to as a reflex. The application of like stimuli to non-corresponding points of the two retinas is supposed to constitute the adequate stimulus for evoking the reflex. The nearer the two stimuli come to falling on corresponding points, the more effective they are in evoking the reflex, and if the image on one retina falls too far away from the point corresponding to the image on the opposite retina, no response can be obtained. Undoubtedly the operation of such a reflex mechanism must play a dominant role in the reversion to fusion, but it is necessary to reckon with a certain amount of voluntary control over convergence.

If the patient takes the attitude of doing all he can to recover fusion, the recovery finding will be much higher than if he had taken a passive attitude and waited for the two images to fuse of their own accord. When such an effort is made to fuse the images, presumably what happens is that a voluntary movement of convergence occurs first and then as soon as the diplopia is reduced to the point at which the reflex fusional mechanism can operate, this mechanism helps to complete the recovery of fusion.

The range in prism diopters between the phoria and base-in blur point (See Fig. 1) measures the so-called amplitude of negative fusional convergence and the range between the phoria and the base-out blur point represents the so-called amplitude of positive fusional convergence. When no blurring precedes the break point, the break point itself is regarded as the limit of fusional convergence.

In the blur point test the operator makes an effort to throw the images off corresponding points of the two retinas by gradually increasing the prism power. The reflex fusional mechanism compensates the effect of the prisms by making the eyes turn as the prism power is increased. As long as the increase in the power of the prism is compensated solely by the operation of the reflex fusional mechanism, the target remains perfectly clear. When blurring does occur, it means that the refracting system is thrown out of focus by over-accommodation in the base-out test and under-accommodation in the base-in test. These changes in accommodation assist in maintaining fusion because every time accommodation increases or decreases the associated convergence must follow suit.

It seems to require a special knack to throw accommodation out of

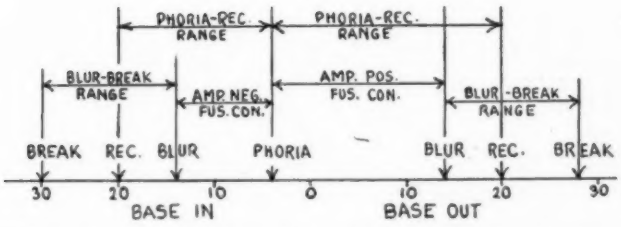

Fig. 1—Diagrammatic Representation of the Relations between Phoria, Blur, Break and Recovery Findings at the Near Point.

focus to get an increase or decrease in convergence, as is demonstrated by the fact that many persons experience no blurring before the break occurs. Table I shows the 100 cases grouped according to the size of the blur-break range on the base-out side. Table II shows the 100 cases grouped according to the size of the blur-break range on the base-in side. The scatter diagram in Fig. 2 shows the base-in blur-break range plotted against the base-out blur-break range. This analysis of the data shows that some individuals can over-accommodate to get an increase of convergence on the base-out side, but cannot relax accommodation to decrease convergence on the base-in side. The situation is just opposite for other individuals. In only two cases is there manifest a total inability to manipulate accommodative convergence in either direction.

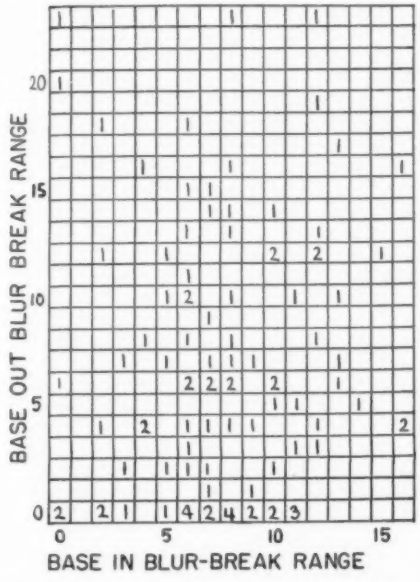

Fig. 2—The Relation between the Base Out and the Base In Blur-Break Ranges in 100 Cases.

There are two factors which might be responsible for an inability to throw accommodation out of focus, when the reaction to base-in or base-out prism is being tested. In the first place the observer may have failed to acquire voluntary control of accommodation and accommodative convergence in a situation of this kind. In the second place the ratio between accommodative convergence and accommodation may be virtually zero and hence no change in convergence can be produced by over or

TABLE I

Grouping of the One Hundred Cases According to the Size of the Base-Out Blur-Break Range

Base Out Blur-Break Range	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Frequency	23	2	5	3	10	3	10	6	4	1	6	1	7	3	3	2	3	1	2	1	1			3

TABLE II

Grouping of the One Hundred Cases According to the Size of the Base-In Blur-Break Range

Base In Blur-Break Range	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Frequency	5	0	5	3	4	5	16	11	14	5	9	6	8	4	1	1	3

under accommodating. Unfortunately the data were not complete enough to determine the ratio between accommodative convergence and accommodation, but as long as a measurable blur-break range can be obtained on either the base-in or base-out side, the ratio cannot be zero. This means there are only two cases in which the absence of a relationship between convergence and accommodation might be regarded as a possible factor in producing a zero blur-break range.

Analysis of the Factors Affecting the Size of the Blur-Break Range on the Base-Out Side

When the blur-break range on the base-out side has a measurable size, the breaking point may be supposed to depend upon three factors. In the first place, as convergence is increased beyond the blur point, accommodation is thrown out of focus and the images get more and more blurred. Finally the letters get so blurred that blurredness becomes an obstacle to the operation of the reflex fusional mechanism. In the second place, the amount of blurring that can be tolerated, depends in part upon the degree of voluntary control over the situation. And in the third place, the amount of convergence resulting from the effort to throw

accommodation out of focus varies depending upon the ratio between accommodative convergence and accommodation (Hereafter referred to as the A.C.A. ratio). Unfortunately the data were not complete enough to determine the A.C.A. ratio and the role played by this factor could not be investigated.

The near point of convergence constitutes an absolute limit for the break point on the base-out side, but the break point finding seldom reaches such an extreme. Assuming that the near point of convergence falls at 5 cm. from the root of the nose; the maximum base-out to break at 40 cm. would be about 65△. The near point of convergence can, therefore, hardly be regarded as a factor limiting the base-out break finding.

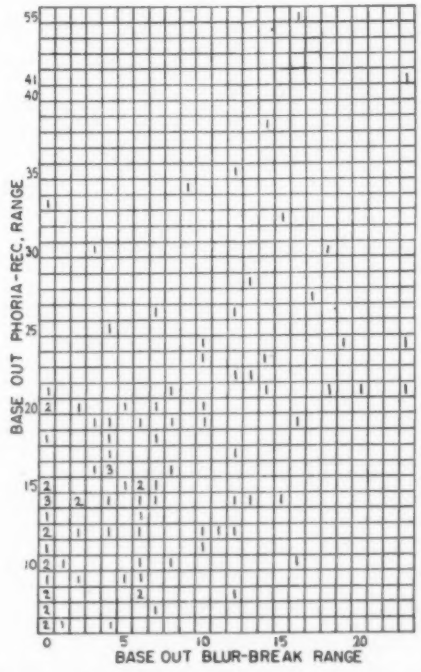

Fig. 3—Scatter Diagram Showing the Relationship between the Base Out Phoria-Recovery Range and the Base Out Blur-Break Range in 100 Cases.

The Relation of the Blur-Break Range to the Phoria-Recovery Range on the Base-Out Side

The scatter diagram in Fig. 3 shows the base-out phoria-recovery range plotted against the base-out blur-break range. The positive correlation demonstrates that a common factor is involved in both tests. As

already explained, the phoria-recovery range depends upon the additive effects of the strength of the reflex fusional mechanism and a convergence movement induced by voluntary effort. Since the blur-break range does not involve the operation of the reflex fusional mechanism, voluntary control of convergence seems to be the most likely common factor in the two tests.

If the voluntary control in the recovery test is to be identified as the same type of voluntary control as manifested in the blur-break range, accommodation must be thrown out of focus every time a recovery involves a voluntary movement of convergence. This sort of thing definitely occurs in those cases in which the recovery finding is higher than the blur finding. Of the 77 subjects who demonstrated their ability to over-accommodate to increase convergence by showing a measurable range between the base-out blur and break points, 28 yielded higher recovery points than blur points. In such cases a voluntary increase in accommodation must be involved in the process of reversion to fusion.

Presumably also a period of blurring might be obtained at the moment of recovery when prisms of less power than those represented by the blur point are suddenly placed before the eyes. Several subjects who have been tested specifically on this point report a momentary blurring, but data on this point have not been systematically obtained in the 100 cases used in this investigation.

The clearing up process which follows the momentary period of blurring undoubtedly involves the substitution of reflex fusional convergence for voluntarily induced accommodative convergence. The process of substitution must involve a relaxation of accommodative convergence bit by bit which throws the stimuli slightly off corresponding points, and the reflex fusional mechanism operates to bring the images back to corresponding points. The shifting of the images is not enough to produce diplopia and the only thing noticed is the clearing up of the blur. This process can be carried on till the limit of fusional convergence is reached or until the image becomes perfectly clear.

Analysis of the Factors Affecting the Measurable Amplitude of Positive Fusional Convergence

The limit to which the reflex fusional mechanism can drive convergence in the base-out to blur test may be determined by one or both of two factors, (1) the inability to keep accommodative convergence from coming into play, and (2) the increasing difficulty of operation of the reflex mechanism as positive fusional convergence is increased.

Whenever a person has acquired voluntary control of accommodative convergence he can deliberately throw his accommodation out of focus and thereby eliminate the necessity of the operation of the reflex fusional mechanism, and hence a low amplitude of positive fusional convergence may have no more significance than this, namely, that the individual permitted accommodative convergence to come into play before the reflex mechanism had an opportunity to drive positive fusional convergence to its limit. However, there is no way of determining from the data whether this factor was operative in any of the cases.

At least in the 23 cases in which the base-out blur-break range is zero, there is no tendency for accommodative convergence to come into play, and hence this tendency cannot constitute a limiting factor. In

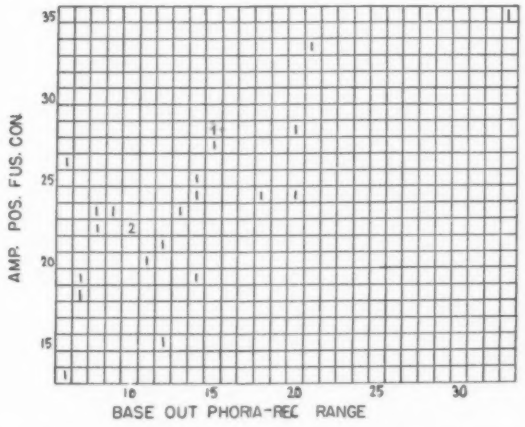

Fig. 4—Scatter Diagram Showing the Relationship between the Amplitude of Positive Fusional Convergence and the Base Out Phoria-Recovery Range in 23 Cases Who Experience No Blur in the Base Out Test.

order to throw light upon the nature of the limiting factor in such cases, the amplitude of positive fusional convergence was plotted against phoria-recovery range, as shown in Fig. 4. This scatter diagram definitely indicates a positive correlation. Since it may be assumed that there is no voluntary control over accommodative convergence in either test, the positive correlation must mean that both measurements depend upon the vigor of the fusional reflex.

In order to explain how the strength of the fusional reflex affects the limit of positive fusional convergence, it must be assumed that this limit involves a spring action in which the operation of the reflex becomes more difficult as positive fusional convergence increases. The limit repre-

sents a point of equilibrium between inherent strength of the fusional reflex and the increasing opposition which it encounters as the base-out prism increases.

It should be noted that the strength of the reflex fusional mechanism must make itself manifest in different ways in the two types of tests. In the recovery test the crucial factor is the amount of diplopia which is still capable of evoking the reflex. In the blur point test the amount of diplopia is almost negligible, and the strength of the reflex is measured by the amount of resistance that can be overcome.

Analysis of the Base-In Findings

We might expect to find the same type of fundamental relationships to hold on the base-in side as on the base-out side, but for one reason or another these relationships are more difficult to demonstrate on the base-in side.

In the first place, the base-in break finding at near is determined by the absolute limit of divergence in most cases. In order to demonstrate this relationship the base-in break findings at near were plotted against base-in break findings at distance (Fig. 5). The diagonal line represents those cases in which the base-in break point at near corresponds exactly to the absolute limit of divergence as determined by the base-in break findings at distance. In comparing the findings at the two distances a

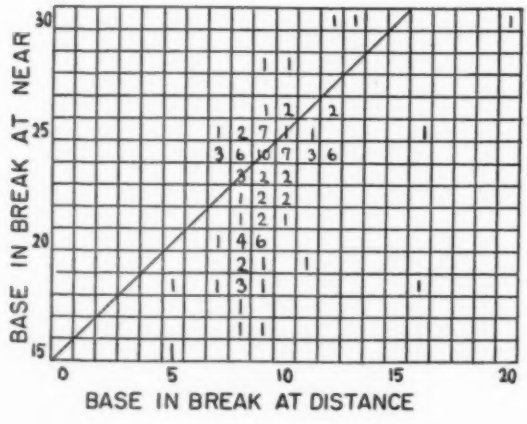

Fig. 5—Scatter Diagram Showing the Relationship between the Base In Break Finding at Near and the Base In Break Finding at Distance in 100 Cases. The diagonal line represents those cases in which the base in break finding at near corresponds exactly to the absolute limit of divergence as measured by the base in break finding at near.

15△ diopter allowance must be made for the increased initial convergence at the near point. In general it can be said that the major factor determining the base-in break point at near is the absolute limit of divergence. This means that the blur-break range on the base-in side is primarily a measure of the accommodative convergence associated with 2.50 D. of accommodation, and cannot be regarded as an index of different degrees of ability for decreasing convergence by voluntarily relaxing accommodation.

The fact that the base-in recovery point exceeds the base-in blur point in 57 per cent of the cases demonstrates that in these cases the voluntary relaxation of accommodative convergence is a factor in the recovery test.

Summary

An analysis of the relationships between the phoria, blur, break and recovery findings in 100 cases permits the following conclusions to be drawn:

(1) Twenty-three of the cases failed to show a measurable range between the blur and break points on the base-out side; that is to say, the target doubled before blurring. Since no blurring is obtained in so large a percentage of the cases, it may be assumed that throwing accommodation out of focus to obtain an increase in convergence is a special knack which has to be acquired.

(2) In the remaining 73 cases, a positive correlation was obtained between the size of the blur-break range and the phoria-recovery range. This positive correlation is interpreted to mean that the ability to throw accommodation out of focus to get an increase in convergence is at least one of the factors which helps to determine the size of the phoria-recovery range. This assumption is further substantiated by the fact that 28 of the 77 subjects yielded higher recovery points than blur points. When this occurs, it indicates clearly that accommodation is thrown out of focus to recover fusion.

(3) In the 23 cases with a zero blur-break range it may be assumed that there is no capacity for manipulating convergence by throwing accommodation out of focus, and hence the recovery of fusion must depend upon the operation of the reflex fusional mechanism. In these cases a positive correlation was demonstrated between the phoria-recovery range and positive fusional convergence, which means that both types

of measurements are dependent upon the strength of the reflex fusional mechanism. In order for the measured limit of positive fusional convergence to vary with the strength of the reflex fusional mechanism, it must be supposed that the measured limit is a point of equilibrium between the strength of the reflex fusional mechanism and some form of resistance which increases as positive fusional convergence increases.

(4) The base-in break point corresponds closely to the absolute limit of divergence, and therefore the blur-break range is for the most part a function of the amount of accommodative convergence associated with 2.50 D. of accommodation.

DISCUSSION

DR. PETRY: In my own research we found that on increasing the deviating prism after displacement, that there was no exact relationship between the added displacement that was caused in the visual projection, and the amount of added prism power. We also found that we altered the phoria results. This resulted in the conclusion, though not definite, that as the result of the patient's cooperating attitude under test, he tends to overcome, at least in part the deviating prism. The resultant accommodation convergence projection would not be what we might call his normal projection. As a result of these findings it does not seem to me entirely correct to say the eyes assume their phoria after the break.

DR. FRY: In regard to Dr. Petry's question about the phorias, which I understand were in a vertical direction, the failure to obtain an exact correspondence between the prism placed before the eyes, and the amount of diplopia which was actually obtained, might be attributed to the fact that in these experiments the dissociation was both in the horizontal and vertical direction. If you dissociate the eyes with a vertical prism, you permit the eyes to deviate in or out as you like. The very act of deviating might involve a vertical component and would affect the dissociation as seen by the two eyes.

DR. BEITEL: How did you know the eyes were in the phoria position?

DR. FRY: No effort was made to determine if the eyes did assume

the phoria position. That was the basic assumption upon which the analysis was made, and may vitiate the results.

DR. SHURIN: In those cases where you had no blur out and a fairly high break point, were any controls used to determine possible suppression?

DR. FRY: The optometrist, from whose practice these data were taken, checks the possibility of suppression.

AN ANALYSIS OF CLINICAL DATA ON ANISEIKONIA WITH CASE REPORTS*

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The clinical data on aniseikonia presented herein covers that period from May, 1933 to September, 1940, and represents analyses, measurements, and corrections made in my own practice.

There is a wealth of material on the theoretical aspects of this subject in the available literature and my contribution should rightfully be on the practical side.

In previous papers on aniseikonia, I have confined myself to clinical data and shall do so largely in this paper. The data obtained are being presented as concisely as possible with the basic thought of bringing out important clinical aspects of the work.

From the questions constantly asked regarding aniseikonia, I am impelled to tabulate the answers in the order of the frequency of these questions and not on their importance. I shall, however, dwell particularly on the data that experience has taught to be most important and to illustrate with actual case records the points I wish to make.

TABLE I

How prevalent is aniseikonia? The following data are compiled from the examination of 1200 cases presenting themselves in routine practice from June, 1933 to January, 1935.

Total number examined	1200
Aniseikonia demonstrated	812=68%
Aniseikonia corrected	181=22% of 812

The tests for aniseikonia were made after the usual procedure of visual analysis, for the purpose of determining the frequency of this

*An abridgment of the material presented before the American Academy of Optometry. For publication in the September, 1941 issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

anomaly. The instrument used was the Ophthalmo-Eikonometer with technique developed at Dartmouth Eye Institute.

(Routine office practice since Jan., 1935.)

Examination for aniseikonia is not given unless indicated by history, symptoms or specific reference.

	Cases examined	Aniseikonia demonstrated	Aniseikonia corrected
1935	1000	140	40=28%
1936	900	146	38=23%
1937	1000	264	78=27%
1938	700	289	79=24%
1939	700	310	114=36%*
1940	360 (6 Mos.)	220	76=35%*

Correction for aniseikonia was not given unless patient demonstrated sensitive or narrow amplitudes. The meaning of amplitudes used in this connection is "the range through which the patient retains equality of images while aniseikonic lenses are applied, increasing or decreasing the relative size of the ocular images."

TABLE III

What percentage of cases obtain relief? The following compilation is the result of "reports" by patients (1 month) after correction.

600 Cases—	Definite relief	384	= 64%
	Partial relief	109	= 18%
	No relief	76	= 18%
	No report	31	

A more specific answer to above question was obtained by a questionnaire sent to 400 patients. See Table IV.

TABLE IV

Questionnaire embodying the following *principal* questions sent to 400 patients. Total number of replies, 289. No replies, 111.

Question V—Are you wearing the glasses prescribed by us as you fill out this report? Yes, 231. No, 58.

Question VI—Indicate the extent to which your glasses have been helpful in removing the trouble with your eyes. Completely, 191. Partially, 59. Not at all, 39.

*Per cent increase due to "referred" cases.

Question VII—Indicate how you think your glasses have affected you generally: Definitely helpful, 156; Somewhat helpful, 59; Not helpful, 39; Not sure, 35.

Question VIII—In case you have discarded the glasses, please state when and why: 26 no relief; 20 wearing glasses at times but do not like appearance. 12 replied: "Glasses somewhat helpful but expense too great to consider re-examination."

TABLE V

In what type of refractive error is aniseikonia most frequently found? This has been reported in detail in my previous papers and by the Dartmouth Eye Institute. Substantially it may be answered as follows: Clinical data disclose that aniseikonia is found most frequently in anisometropes but very frequently in isometropia and not infrequently in emmetropia.

Anisometropia of more than 1. D difference	236=39%
Anisometropia of from .50 D to 1. D	180=30%
Isometropia (less than .50 D difference)	150=25%
Emmetropia	34=5+%
Total	600

TABLE VI

What are the principal symptoms? In order of frequency.

General		Ocular	
Headaches	68%	Eyes tire (general)	72%
Vertigo	12%	Eyes tire at movies	68%
Car or train sickness	12%	Eyes tire at near	65%
Nervousness (tension)	12%	Photophobia	49%
Migraine (typical)	7%		

TABLE VII

What is the average amount of aniseikonia found, and what type most frequent? The type and amount of aniseikonia varies considerably and cannot be definitely predetermined by type or amount of refractive error. The following table concisely answers the question:

	Amount		
Type	Smallest	Largest	Average
Overall	.50%	4%	1.2
Meridional	.50%	4.50%	1.64
Overall-Meridional	.50% O.A. .75% M.	3% O.A. 3.50% M.	1% O.A. 1.25% M.

Type	No.	
Overall	108	18%
Meridional (Horizontal)	210	35%
Meridional (Vertical)	168	28%
Overall-Meridional (Horizontal)	84	14%
Overall-Meridional (Vertical)	30	5%

TABLE VIII

What is the effect of the correction of aniseikonia on phorias and fusional amplitudes?

Report on 152 Cases:

Exophoria at 20 ft. = High Exophoria at 16 in.	36
Exophoria at 20 ft. = Esophoria at 16 in.	24
Esophoria at 20 ft. = High Esophoria at 16 in.	32
Orthophoria at 20 ft. = High Exophoria at 16 in.	40
Orthophoria at 20 in. = Esophoria at 16 in.	20
Hyperphoria 20 ft. (over 1ΔD.)	12
Hyperphoria 16 in. (over 1ΔD.)	14
Low positive accom. reserve	72
Low negative accom. reserve	76

Upon subsequent examinations:	No.
Showing less exophoria at 16 inches	24
Showing less esophoria at 16 inches	22
Showing change from esophoria to exophoria at 16 inches	12
Showing improved P. Acc. R.	38
Showing improved N. Acc. R.	26
Showing no change in Phorias	94
Showing no change in Acc. R.	84
Showing less Hyperphoria	4
Prism corrections removed	30

TABLE IX

What is the effect of the correction of aniseikonia on quality of fusion and stereopsis?

Cases showing low grade fusion	186
Cases showing low grade stereopsis	94
Upon subsequent examinations:	
Cases showing improved fusion	102

Cases showing improved stereopsis 41
Elapsed time, three months to two years.

TABLE X

What changes have been made in aniseikonic correction upon re-examination after one year or more?

Number of re-examinations	216
No change in aniseikonic correction	141
No change in refraction	38
Change in aniseikonic correction	36
Change in refraction correction	178
Correction reduced in 24 Cases	Average change 50%
Correction increased in 12 Cases	Average change 75%
Correction removed in 39 Cases*	

Under Table II, the writer stated that correction for aniseikonia was not given unless patient demonstrated sensitive or narrow amplitudes. I wish here to elaborate somewhat on this factor as clinical experience shows definitely that amplitudes, or the range through which image size may be controlled, or difference in image size may be tolerated, varies greatly with the individual just as we find tolerances for refractive errors and muscular imbalances.

Likewise tolerances to this anomaly may be "built up" just as we find a "build up" in the correction of refractive errors, evidenced by the fact that many cases are perfectly "comfortable" for a time without correction. This experience, as far as refraction is concerned, is manifest in your practice as well as in mine.

It has been my experience that many cases after wearing a correction several months have, upon re-examination, shown wider amplitudes, and upon removal of correction, maintain relief from symptoms. Several of these cases, however, reported return of symptoms after a few weeks.

These experiences led to a more careful analysis of amplitudes with a definite technique as follows: To simplify, I will take an overall type. Overall size is increased in R. or L. eye, as case indicates, by 1% steps until reversal occurs, then reduced by .50% steps until reversal in opposite direction; then increase by .25% steps until equality is obtained. Then using overall size lenses on other eye, image is increased and decreased by 50% steps. If amplitude is not equal in each direction, correction on other

*Aniseikonic correction removed either because wider amplitudes were demonstrated (31) or patient wished to avoid expense (8).

eye is altered until amplitude is equal in each direction. This technique may be employed with meridional type in the same manner. If the patient demonstrates amplitudes in each direction of 1.50% or more, it is generally true that the aniseikonia will be tolerated without correction. If, however, the amplitude is 1% or less, the patient will be less able to go without correction.

CASE REPORTS

Case 1. Narrow amplitudes: Mr. L. B., student. Age 20, 1932. Symptoms: Marked photophobia, excessive lachrymation, vision blurred after two hours of study and both eyes became sore and a general headache ensued, all of which disappeared after a night's rest.

General history: Health generally fair but does not take much physical exercise. Has had two operations for sinus trouble as well as violet ray and "baking" treatments for this condition. Four tonsillectomies due to recurring growths. Teeth have been straightened and are in good condition.

Ocular examination: External examination negative; Ophthalmoscopic examination negative. P.P. Acc. 8 inches. P.P. Conv. 8 inches. Naked vision 20/20 O. U.

Present Rx.: R.+0.25⌒+0.50 Cyl. Ax. 180 V.=20/20.
L.+0.50⌒+0.50 Cyl. Ax. 180 V.=20/20.

This correction was given May, 1932, afforded some relief. The prescription worn previous to that date contained high prism correction, base-in over both eyes, but it was impossible for him to wear them. Cannot wear present correction for distance on account of fogging. Also, when he looks down through present glasses he becomes confused and has had several falls when going down stairs.

Refraction: Keratometer:
R. 43.25 Ax. 10 /43.00 Ax. 100
L. 42.75 Ax. 180/42.75 Ax. 90

Static Skia.:
R.+1.00—1.25 Cyl. Ax. 100
L.+ .75— .50 Cyl. Ax. 90

Dyn. Skia. 40":
R.+1.50—1.25 Cyl. Ax. 100
L.+1.25— .50 Cyl. Ax. 90

Subjective:
R.+1.00—1.25 Cyl. Ax. 100 V.=1
L.+1.00— .50 Cyl. Ax. 90 V.=1
Induced Phoria: 3° Exo.
Distance: Add. 18/8 Abd. 10/6
Near: 8Δ Exo. Add. 24/10 Abd. 24/18
P. Accom. R. at Near—3.00 O. U.
N. Accom. R. at Near+2.50 O. U.

Aniseikonia: 20 feet: R. ocular image relatively larger overall. Required 2% overall on left eye to equalize images. 3.50% made left image larger. Reduced to 1.50% then right image larger. This demonstrated rather wide amplitude.

2.50 D. or 16 inches: R. ocular image smaller in horizontal meridian. Required 2% M. Ax. 90 on R. eye to equalize amplitude 1% each way.

Following prescription given Dec. 10, 1932:
R.—0.25⌒+1.25 Cyl. Ax. 10⌒2% M. Ax. 90 (fitover)
L.+0.50⌒+0.50 Cyl. Ax. 180

April 11, 1933, reported definite relief for two weeks; then removed aniseikonic fitover. Comfortable for two months but recently headaches returning.

Re-examination: Aniseikonia 1.25% M. Ax. 90 to equalize. Amplitude 75% each way.

Refraction:
R.+1.25—1.50 Cyl. Ax. 102
L.+1.00— .87 Cyl. Ax. 85

Gave following correction:
R.—0.25⌒+1.50 Cyl. Ax. 12
L. +0.87 Cyl. Ax. 175

This prescription gave no relief. Added 1% M. Ax. 90 to O. D. in fitover; immediate relief obtained. Above prescription worn until Dec., 1935. Tried several times to remove fitover aniseikonic lens but discomfort soon followed:

Dec., 1935, changed correction to:
R.+1.00⌒—1.50 Cyl. Ax. 103⌒1% M. Ax. 90
L.+0.75⌒—1.00 Cyl. Ax. 82

This done to "clear" distance vision.

Aug. 22, 1939, reported comfort while fitover was worn.

Amplitudes 50% each way.

Correction changed to:

R.+1.25⊂—2.25 Cyl. Ax. 103⊂1% M. Ax. 90
L.+0.75⊂—1.25 Cyl. Ax. 82

At this time aniseikonic correction was incorporated in permanent lens form.

May 10, 1940, reported continued comfort.

Case 2. Wide Amplitudes: Mr. E. R. Age. 49, Executive. Symptoms: Nervous tension for year. Use of eyes in reading or driving increased this nervousness and tension. Various changes in glasses over a period of 10 years had not relieved trouble although each eye specialist had attributed trouble to eyes. Several physicians had typed the case as neurotic.

March 10, 1938, first examination. Naked vision: R. 20/40; L. 20/20

Ophthalmoscopic examination negative.

Keratometer:

R. 42.75 Ax. 160/43.50 Ax. 70
L. 42.50 Ax. 170/43.75 Ax. 80

Present correction:

R.—0.25⊂—0.37 Cyl. Ax. 110=V. 20/30
L.+0.25⊂+0.37 Cyl. Ax. 75=V. 20/20

Skia., Static and Dynamic eliminated.

Subjective:

R.—0.50 Sph. =V. 20/26
L.+0.75⊂—0.75 Cyl. Ax. 170=V. 20/20

Dis. Phoria—1 Exo. Add. 9/6 Abd. 10/4
Pres. Correction 1.50 O. U.
Near Phoria—12Δ Exo. Add 9/6 Abd. 20/14
Aniseikonia: R. ocular image smaller in horizontal meridian 2%.
20 ft.
16 in. R. ocular image smaller in horizontal meridian 3%.

In both distance and near the amplitudes were small—change of 50% in either direction was noticeable.

Correction given:

R.—0.25⊂—0.12 Cyl. Ax. 100⊂2.25% M. Ax. 90
L.+0.62⊂—0.75 Cyl. Ax. 170

Near: Add O. U.+1.50 Sph. Bifocals.

May 15, 1938, reported definite improvement.

Oct. 23/39, second examination. Continued comfort at distance but some fatigue in reading.

Re-examination showed larger amplitudes for aniseikonia.

Prescription for Dist.:
R.—0.12⌒—0.37 Cyl. Ax. 105⌒50% O.A.⌒1.50% M. Ax. 90
L.+1.00⌒—0.62 Cyl. Ax. 160

Near: Add O. U.+1.75. Bifocals.

Aug. 20/40: Continued comfort at distance but marked fatigue in reading.

Re-examination—Subj. on O. E.
R. —.37 Cyl. Ax. 105
L.+1.00—.50 Cyl. Ax. 160

Aniseikonia at distance: 1% M. Ax. 90 with 1.50% amplitudes.

Aniseikonia at near: 2.50% M. Ax. 90 with 1.00% amplitudes.

Bifocal correction:
R. —0.37 Cyl. Ax. 105
L.+1.00⌒—0.50 Cyl. Ax. 160
+2.00 O. U. add for Near. *No Aniseikonic correction.*

Special Near Point Correction:
R.+2.00⌒—0.37 Cyl. Ax. 105⌒2.50 M. Ax. 90
L.+3.00⌒—0.50 Cyl. Ax. 160

Relief noticed immediately. Comfort continued for near, but one month later noticed fatigue in driving and at movies. Sept. 25, 1940, gave fitover 1% M. Ax. 90 to wear on R. eye of bifocals when needed. Reported immediately that this gave relief.

TABLE XI

The following data on Amplitudes are taken from 35 Cases that could be conveniently studied.

No.	Type	Amount		Time Worn
18	Horizontal	1% to 3%		1 year or more
	Correction	Increased	Reduced	Not changed
		4	5	9
	Amplitudes	6	2	10

7	Vertical	1% to 2.50%		1 year or more
	Correction	Increased	Reduced	Not changed
		2	2	3
	Amplitudes	4	1	2
10	Overall	1% to 3.50%		1 year or more
	Correction	Increased	Reduced	Not changed
		4	2	4
	Amplitudes	6	0	4

This shows in general an increase in amplitudes and particularly in the Overall type.

To illustrate graphically successes and failures in the correction of aniseikonia, I am citing several cases of different types that are worthy of study.

Case 3. Migraine Case, Miss D. C. F. Age 37. Teacher. Oct. 26, 1939. Symptoms: Dragged out feeling after work each day. Headaches for many years—diagnosed as migraine. Medical treatment affords slight relief. Photophobia.

History: General health good. Nervous at times. Many changes in glasses—no relief from headaches. Some orthoptics.

Present correction:

R.+0.75⌒+0.50 Cyl. Ax. 165=V. 17/15 Naked V. R.=17/50
L.+0.25⌒+0.75 Cyl. Ax. 180=V. 17/15 Naked V. L.=17/50

Ophthalmoscopic examination negative. Pupillary reflexes normal.

Keratometer:

R. 44.00 Ax. 170/44.50 Ax. 80
L. 44.00 Ax. 5/44.25 Ax. 95

Skia. Static:

R.+1.50—.50 Cyl. Ax. 75
L.+1.25—.75 Cyl. Ax. 90

Skia. Dynamic: 40 In.

R.+2.00—.50 Cyl. Ax. 75
L.+1.75—.75 Cyl. Ax. 90

Subjective:

R.+1.50—.50 Cyl. Ax. 75 V. 17/15
L.+1.25—.75 Cyl. Ax. 90 V. 17/15

Dis. Phoria .50 Exo. Add. 16/10 Abd. 6/2

Near Phoria 1. Exo. Add. 18/12 Abd. 12/4

Aniseikonia: R. ocular image larger in horizontal meridian 1%. Amplitude 50%.

Nov. 6/39. 2nd examination gave same results.

Correction given:

R.+1.50⌒—0.50 Cyl. Ax. 75

L.+1.25⌒—0.75 Cyl. Ax. 90⌒1% M. Ax. 90

Glasses delivered Nov. 20, 1939. Reported ten days later definite relief. In reply later to questionnaire, she reported March 19, 1940: "Have suffered for years with migraine headaches. Specialist on migraine managed to cut them down to two a month. Since wearing the glasses you fitted to me on Nov. 20, 1939, have had only one real migraine headache—slight headaches during period some months. I feel these glasses have been the answer to my problem." Note—This case presents no unusual refractive or muscular anomaly and aniseikonia is of small amount but sensitive amplitudes emphasize necessity for correction.

Case 4. Reading Disability. R. McF. Age 13. Student. May 7, 1938. Symptoms—None. History: Handicapped in school because of reading difficulties. Report by remedial reading teacher from ophthalmograph recording: "One eye higher; vertical imbalance; lack of binocular co-ordination shown by absence of parellelism. Note point in graph at beginning of first fixation. This irregular activity prevents fusion. Probably reads with one eye. Number of regressions excessive. Note: Seriously handicapped because he requires many minute and precise fixations. Left eye trailing right eye; right eye over converges at end of return sweep. Refer to eye specialist." This boy was examined by three eye specialists and was told by each that glasses were not necessary. Later examined at Psycho-analytical Clinic where aniseikonia was demonstrated.

External and Ophthalmoscopic examination negative.

Refraction:

R.+0.37⌒—0.50 Cyl. Ax. 180=V. 20/20 Naked V.=20/20 R.

L.+0.25⌒—0.12 Cyl. Ax. 180=V. 20/20 Naked V.=20/20 L.

Phorias:

Dis. 4Δ Eso. Add 18/12 Abd. 7/4

Near 1Δ Eso. Add. 22/14 Abd. 16/12 .50 R. Hyper.

Pos. Acc. Res., —3.00 Neg. Acc. Res. +2.25

Fusion 80% (Keystone)

Aniseikonia:

R. ocular image smaller in horizontal meridian 2%.
Amplitudes .75%.

Correction:

R.+0.37⌒—0.50 Cyl. Ax. 180⌒2% M. Ax. 90
L.+0.25⌒—0.12 Cyl. Ax. 180

June, 1938: Teacher reported marked improvement in concentration, comprehension and speed in reading.

Aug. 30, 1939 Re-examination:

Refraction:

R.+0.37⌒—0.50 Cyl. Ax. 180
L.+0.37⌒—0.25 Cyl. Ax. 180

Phorias:

Dis.: 3 Eso. Add. 18/14 Abd. 9/5
Near: 1 Exo. Add. 22/14 Abd. 18/12

Fusion: 100%

Aniseikonia:

R. ocular image smaller by 2% in horizontal.
Amplitudes 1%.

Correction:

R.+0.37⌒—0.50 Cyl. Ax. 180⌒1.50% N. Ax. 90
L.+0.37⌒—0.25 Cyl. Ax. 180

Sept. 20, 1940: Reported good progress in school. Re-examination —no change in correction.

Case 5. Marked Anisometropia. O. E. Age 25. Female. No occupation. Symptoms: Headaches. May 2, 1940.

Present Correction:

R.—3.00⌒—1.75 Cyl. Ax. 180 V.=17/25
L.—3.00 Sphere. V.=17/300—

Ophthalmoscope—Negative

Refraction:

R.—3.00—2.25 Cyl. Ax. 180 V. 17/20
L.—8.00— .75 Cyl. Ax. 180 V. 17/30

Aniseikonia:

Right ocular image larger 4% O. A. +

Correction Given:

R.—3.00⌒—2.25 Cyl. Ax. 180
L.—8.00⌒—0.75 Cyl. Ax. 180⌒4% O. A. (Fitover)

May 20, 1940, reported: Marked distortion and confusion first three days. Headaches not relieved until May 15th. Confusion growing less each day and vision much improved. Checked refraction and aniseikonia. No change. Vision in R. eye 17/20, L. eye 17/20. Continued 10 days longer with temporary correction.

June 3, 1940, reported: Headaches much less frequent. No confusion. Made correction in permanent form.

Case 6. Failure. W. H. P. Male. Age 29. Teacher. Dec. 29, 1939, Symptoms: Headaches and nausea. History: Fifteen years of headache, not relieved by glasses nor medical treatment. Examined at Mayo Clinic summer of 1939. Diagnosed as "Tension Headaches."

Wearing:

R.—2.00 Cyl. Ax. 160. V.=17/15
L.—2.50 Cyl. Ax. 180. V.=17/20

Ophthalmoscope—Negative

Refraction:

R.—2.25 Cyl. Ax. 160 V. 17/15
L.—3.00 Cyl. Ax. 180 V. 17/15

Phoria:

Distance 1Δ exo. .50 L. Hyperphoria
Near 8Δ exo. Add. 14/10 Abd. 20/16

Aniseikonia at 20 Feet:

R. Ocular image larger in vertical meridian 1.50%.

Aniseikonia at 16 Inches:

R. Ocular image larger in V. 1.50%.
R. Ocular image smaller in H. 1.50%.
Amplitudes .75%.

Correction Given:

R.—2.25 Cyl. Ax. 160
L.—3.00 Cyl. Ax. 180⌒1.50% M. Ax. 180

Reported in response to questionnaire: "Apparently my eyes have nothing to do with the symptoms described to you. I have noticed no change in my condition as a result of the glasses prescribed by you. I feel that it was a worthwhile effort to find my trouble, however."

A suggestion to try the indicated correction for near was not replied to.

Case 7. Anisometropia. F. R. H. Male. Correction of Oct. 26, 1936:

Far:

R.—14.50⌒—1.00 Cyl. Ax. 10⌒3.50% M. Ax. 100
L.— 8.00⌒—2.50 Cyl. Ax. 170⌒2° B.
down 3.50% M. Ax. 170

Near:

R.—12.00⌒—1.00 Cyl. Ax. 10⌒3.00% M. Ax. 100
L.— 5.50⌒—2.50 Cyl. Ax. 170⌒2° B.
down 3.00% M. Ax. 170

Patient had previously been unable to wear full correction of myopia for right eye.

Case 8. Reading Disability. B. R. Female. Age 12. Student. Right eye dominance. No muscular imbalance. Fusion slow.

Correction:

R.+.50 Sphere
L.+.25 Sphere⌒1.50% M. Ax. 90

Immediate improvement. (Report from parents.)

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MEASUREMENT OF HYPERPHORIA AT THE READING LEVEL*

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In the customary tests for hyperphoria made with dissociating prisms, Maddox rods, etc., the eyes are freed from all fusion stimuli; and if a lateral heterophoria is present, the eyes are permitted to turn in or out as well as to diverge in a vertical direction. Verhoeff[1] has succeeded in devising a procedure whereby the eyes are prevented from deviating outward or inward but yet are given perfect freedom to diverge to a position of rest in the vertical direction. This arrangement has a distinct advantage in that the tendency to vertical deviation may vary with the amount of convergence in force and hence it adds more significance to the finding if the eyes are kept converging for some specified distance.

Verhoeff's principle has been incorporated in the instrument about to be described, which has been especially designed for the measurement of hyperphoria at the reading level. This instrument is essentially a Brewster type stereoscope in which a Stevens phorometer is substituted for the prism lenses. The targets are so designed that the images of the two halves of each target are exactly superimposed when the prism bases are directed outward. Fig. 1 shows a top view of the instrument illustrating the optical principles.

The prisms are synchronized to rotate simultaneously in the same directions. This adds a base-up component in one and a base-down component in the other without appreciable decrease in the base-out component as long as the vertical component is small. Fig. 2 shows the relative sizes of vertical and horizontal components for the different

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[1]Hyperphoria Tests Based on a New Principle. F. H. Verhoeff. Arch. of Oph., 22. 743-759, 1939.

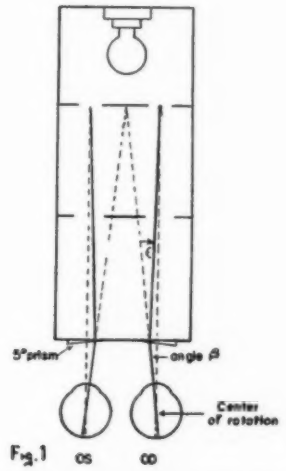


Fig. 1. Diagrammatic view of the instrument illustrating the optical principles.

positions of the prisms. Although the vertical prismatic effects are distributed over both eyes, the combined effect can be treated as equivalent to so much prism base-up or base-down over the right eye. The phorometer was recalibrated in terms of its effective vertical power at the centers of rotation of the eyes. The difference between nominal power

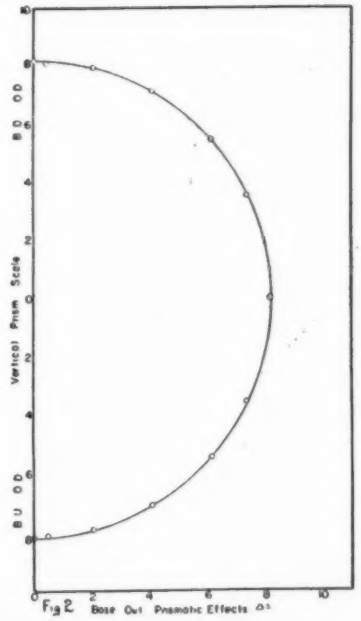


Fig. 2. Illustrating the variation of the base-out prismatic effect as the prisms are rotated to produce various amounts of base up or down.

measured at the prism and effective power measured at the center of rotation is illustrated in Fig. 1. Angle Epsilon is the angle of deviation at the prism. Angle Beta is the rotation of the eye required to compensate the effect of the prism. Effective power is also modified by the lenses worn by subject but this factor has been ignored in calibrating the phorometer.

Dissociation is obtained by means of a two cm. central vertical septum placed 24 cm. from the plane of the prisms. This septum occludes the right half of the test target from the left eye and the left half of the target from the right eye.

A slot for the test targets is provided at a distance of 37.3 cm. from the plane of the prisms. These targets are translucent and are illuminated from the rear by a 25 watt bulb.

The side view of the instrument in Fig. 3 illustrates the method used to rotate the instrument about a fixed axis at the point E. D is a clamping device which moves on the rod supporting the instrument. At E is a celluloid scale calibrated in half degrees from which various posi-

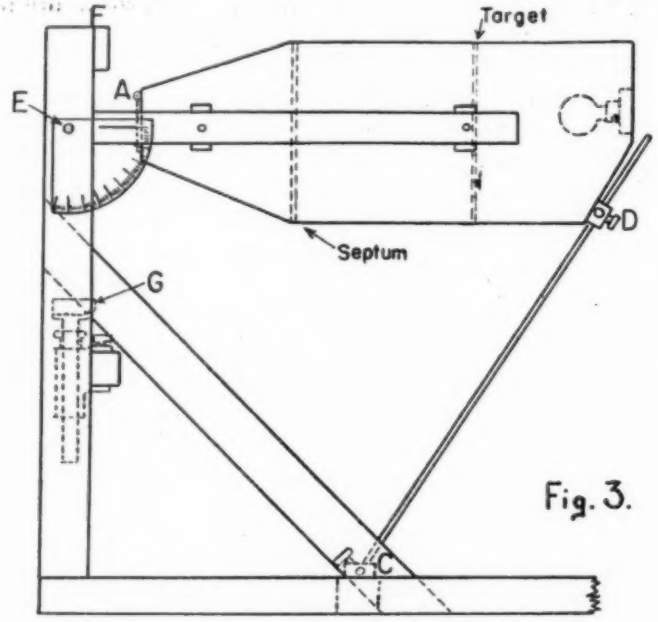


Fig. 3. Side view of the hyperphoria measuring device. The instrument rotates around an axis at E, and its position can be determined by means of the circular scale concentric with E.

tions of the instrument can be determined. The horizontal position is arbitrarily defined as the zero position, and the other positions as angular deviations above or below this position.

The rear surface of the head rest (F) and the chin rest (G) are in the same vertical plane. This prevents the head from pitching forward or backward and keeps the eyes at a fixed distance from the instrument. The chin rest can be adjusted up and down.

A special sighting device was used to insure the proper placement of the patient's eyes. This consisted of a sheet of clear celluloid attached to a block which the operator could fix to the top of the forehead rest while adjusting the position of the patient's head. A horizontal line was marked on the celluloid at the same level as the axis of rotation of the instrument.

In the actual process of adjusting the patient's head the instrument is first lowered so as not to block the field of view. The operator can then close one eye and place himself in front of the instrument with his open eye on the same level as the line on the celluloid. The subject is instructed to look at the open eye. The operator then adjusts the chin rest and has the patient tilt his head toward the right or left shoulder until the centers of the two pupils are lined up with the mark on the celluloid. When this operation is completed the centers of rotation of the eyes fall close to the line corresponding to the axis of rotation of the instrument. The sighting device can then be removed and the operator can raise the instrument into position and begin the measurement of hyperphoria.

One of the targets (Fig. 4) used for measuring the vertical phoria consists of two vertical rectangular openings side by side in a piece of black cardboard. These openings are separated by a distance of 2 cm., so that the septum occludes the left opening from the right eye and the right opening from the left eye. The horizontal dimension of the openings is 2 cm. The left and right openings are 20.5 and 15.5 cm. high respectively. This arrangement compels horizontal binocular fixation and permits the eyes to deviate in a vertical direction to their relative position of rest. Bisecting each of these openings, on a piece of milk glass in contact with the back surface of the cardboard, a vertical black line was drawn to assist the subject in retaining horizontal binocular fixation. On the left side of the vertical line and midway between the top and bottom of the opening is a horizontal arrow with its head toward

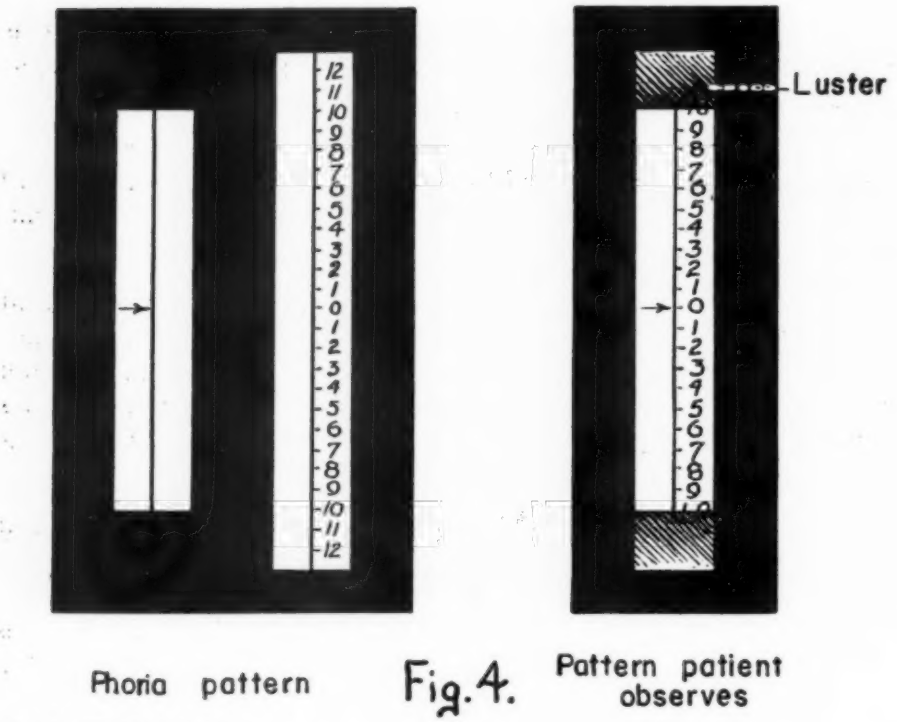


Fig. 4. Phoria pattern.

the black line. A vertical scale, graduated in quarter prism diopters of deviation above and below a zero point on the same level as the arrow head, is located within the right opening on the right side of the vertical line. Thus, the arrow can be made to slide up or down the vertical scale in the binocular image by turning the prisms. If the prisms are set at zero, the position of the arrow relative to the scale is a measure of the vertical phoria. If the prisms are adjusted to make the arrow fall at zero, the position of the prisms is a measure of the vertical phoria. The subject can estimate the apparent position of the arrow to the nearest .1△ on the scale.

Special attention should be called to the value of having the targets of different lengths for the two eyes. If the targets were of equal length, the top and bottom edges might be a stimulus to fusion and prevent a vertical imbalance from becoming manifest. In order to demonstrate the importance of this factor an experiment was set up using a target having openings of equal length (5 cm.) for the two eyes. In this experiment the instrument was mounted horizontally to a floor stand and special forehead and chin rests were used.

The phoria readings were taken while the prisms were set at zero, by having the subject note the position of the arrow on the scale. Similar readings were taken with each increase in prism power of 1△ up to and including 5△. If the subject had no latent vertical phoria, all the readings on the scale should correspond to the prism settings, since they would represent the artificially induced vertical phorias. If the readings were, for example, consistently .5△ greater than the prism settings throughout the entire series of prism settings, one might conclude that the subject's true phoria, as differentiated from the induced phoria, is actually .5△.

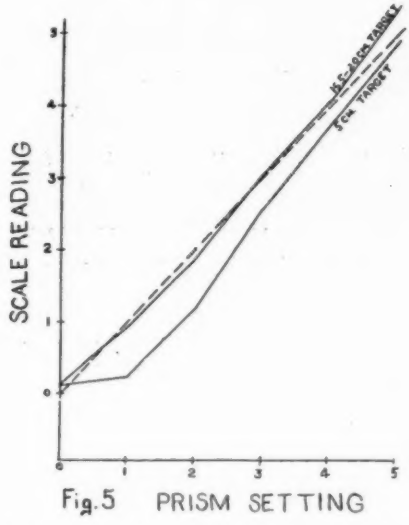


Fig. 5. Demonstration of the fusional movement induced by the top and bottom borders of a phoria target. Data obtained from a typical case.

Figure 5 represents the data obtained in the case of one of the subjects. At the zero prism setting both targets gave a scale reading of .12 D.L.H. At a prism setting of 1.00 prism diopter base-down O.D., the target with equal openings gave an increase of only .12△ in the scale reading, indicating that the right eye was making a supravergent effort to maintain peripheral binocular fixation of the upper and lower borders of the target. This discrepancy between the scale reading and the prism setting gradually decreases but is still present even with a prism setting of 5△. This effect of peripheral fusion is not apparent with the unequal openings, inasmuch as the scale reading increases approximately the same amount as the prism setting.

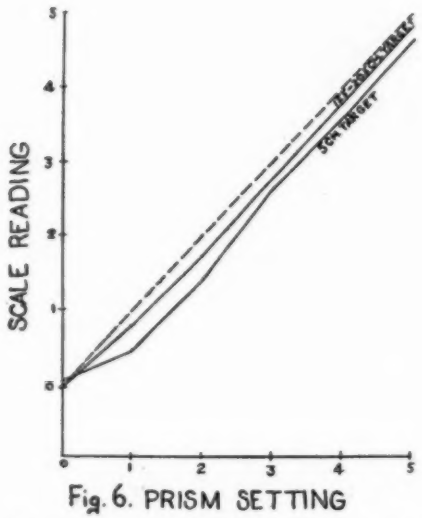
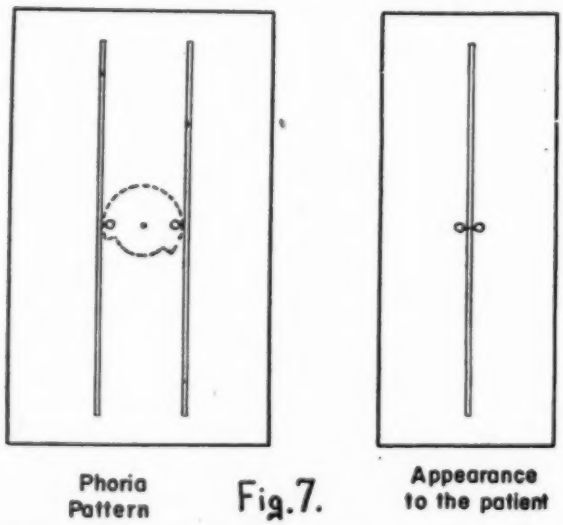


Fig. 6. Demonstration of the fusional movement induced by the top and bottom borders of a phoria target. Data obtained from the average of 16 cases.

Figure 6 presents the corresponding average values for 16 subjects. The same effects are evident in this figure as in Figure 5, but are less pronounced.

A second pattern utilized in the measurement of hyperphoria is illustrated in Fig. 7. The two long vertical slits were each 12.3 cm. long and 3.7 cm. apart. The small circular holes to the inside of the



Fib. 7. Phoria pattern using stroboscopic effect.

slits were 0.2 cm. in diameter. The circular brass disk which served as a flasher mechanism was 3.4 cm. in diameter. The base of the pattern was of pressed wood and it was to this base that the circular disk was attached. By means of a worm gear arrangement, and a 1/200 h.p. motor in series with a rheostat, the disk could be rotated at any desired speed. The 120° open sector permitted the holes to be alternately illuminated with a short period of no illumination for either hole between the alternating flashes. When the speed of the flashes was correctly adjusted, the two dots appeared like a single dot jumping back and forth across the line. In orthophoria, the direction of the jump is perpendicular to the long vertical line, while in right and left hyperphoria the jump is oblique. It is an easy process for the patient to adjust the phorometer until the jump appears perpendicular to the vertical line. The hyperphoria can then be read directly from the phorometer scale.

It is interesting to note the accuracy with which hyperphoria can be measured with this pattern. The average error for 10 settings as determined in 10 separate cases chosen at random is shown in Table I.

TABLE I

Subject	Mean of 10 Readings	Average Deviation
1	.08 LH	.08
2	.01 LH	.09
3	.00	.08
4	.14 LH	.05
5	.12 LH	.04
6	.20 LH	.04
7	.28 LH	.10
8	.01 RH	.11
9	.23 LH	.36
10	.51 RH	.13

Not only can the instrument be utilized for an accurate measure of the vertical phoria but it can likewise be adapted to the measurement of vertical ductions and visual acuity. The duction pattern (Fig. 8) consists of a pair of 2.5 x 2 cm. rectangular openings placed side by side in a piece of black cardboard. In the center of each aperture is a one centimeter black horizontal line painted on a piece of white paper

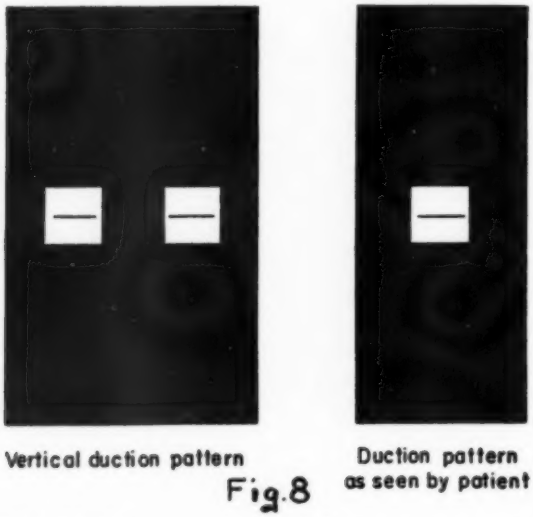


Fig. 8. Vertical duction pattern.

Fig. 9. Visual acuity pattern.

which covers the openings. By turning the prisms from their zero position the fused single image of the lines is made to double. The phorometer scale reading is a measure of the break point. By decreasing the vertical prism power toward zero the recovery point can be reached. This value can also be read from the phorometer scale.

To obtain a measure of the visual acuity the phorometer, which is mounted by hinges, may be swung upward and out of the way. The septum can then be removed and a reduced Snellen pattern (Fig. 9) photographically printed on white paper and mounted in an aperture in a piece of black cardboard, may then be inserted in the target slot. The smallest readable line is a measure of the visual acuity.

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OBSERVATIONS ON OCULAR PRACTICES

The writer has just finished making a detailed study of the geographic distribution of Minnesota optometrists by counties. This study included (1) a preliminary review by counties of all available optometric registration data, (2) the study of special up-to-date county reports on this subject prepared by individual resident county chairmen and (3) personal visits to all but 14 of the 87 counties in the state during which nearly 200 optometric offices were visited, and much local data were compiled on precisely who was doing refractive work in these county areas. The manner in which refractive work was done by optometrists and others was also considered in this study and the results of this phase of the work will be discussed at a later time.

A number of interesting local conclusions were drawn as a result of these studies of the geographic distribution of optometrists as well as several general observations which probably also apply in many of the localities throughout America. Of the more general observations the writer will mention but two at this time.

The first has to do with the influx of medical refractionists into this field, particularly in certain centers. Many of these medical men being improperly trained refractionists. This state wide survey of optometrists naturally included data on other practitioners who were doing ocular work. It was interesting to learn in certain localities, particularly those which had been dominated for years by some locally well known optometrist, that in recent periods as these communities grew and as people became more eye conscious, and as the optometrists became older, medical practitioners, frequently with no background of ocular training, turned to refractive work. This was particularly noticeable in those localities in which the only optometric representative has been, and still is, some optometrist now well along in years.

The dominant place occupied by these optometrists in the refractive field in their localities for many years acted apparently as a deterrent to other optometrists who might have attempted to establish practices in these localities. Yet it failed to prevent certain general medical practitioners from entering the refractive field in these communities. And it failed also to prevent qualified eye physicans from establishing practices in a few of these centers as well.

It is evident, therefore, that in the smaller centers the newly qualified optometric practitioner who is seeking a location could well consider towns already apparently served by an optometrist providing this resident optometrist was found to be already well along in years.

The second general observation made as a result of this state wide survey was that in recent years osteopaths are turning to refractive work to supplement their dwindling practices. The writer knows this is true in Minnesota and is informed that it is true in several other states as well. This matter of osteopathic participation in eye work presents a serious sociologic problem which will require vigorous and forceful action on the part of our societies and State Boards of Examiners if this menace to the future visual welfare of all citizens is to be eradicated.

Carel C. Koch.

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

by J. Fred Andreae, Secretary

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

PRESENTING SPEAKERS WHO WILL APPEAR AT THE ANNUAL MEETING OF THE ACADEMY

In this, and the following two issues, we are presenting a few biographical notes dealing with the speakers who will appear on the program of the American Academy of Optometry at its annual meeting in Chicago at the Morrison Hotel.

In this issue we present four of these speakers. These are: Dr. Herman F. Brandt, of Drake University; Dr. Matthew Luckiesh and Dr. Frank K. Moss of the Lighting Research Laboratory, General Electric Company, Cleveland, and Dr. Henry B. Peters of the Los Angeles School of Optometry.

The complete program of the meeting will be presented in a subsequent issue.

DR. HERMAN F. BRANDT

DR. HERMAN F. BRANDT

Dr. Herman F. Brandt is professor of Applied Psychology and Director of the Visual Research Laboratories of Drake University, at Des Moines, Iowa, and Director of Visual Research for LOOK, INC.

He is a distinguished lecturer, a prolific author, a research scientist of wide experience and an inventor of many instruments. Mention of three of his inventions will give the reader reason for interest in his paper. These are a Bidimensional Eye Movement Camera, and Intermittent Monofilm Portable Eye Camera, and an Electric Counter and Reader Time Recorder.

DRS. MATTHEW LUCKIESH AND FRANK K. MOSS

DR. MATTHEW LUCKIESH

DR. FRANK K. MOSS

Dr. Matthew Luckiesh, in addition to serving as Director of the Lighting Research Laboratory of General Electric Company at Nela Park, Cleveland, is regarded throughout the world as the outstanding authority on lighting.

When Purdue University conferred upon Dr. Luckiesh the degree of Doctor of Engineering for his "outstanding achievements in science," this was one of the few times in sixty-one years that this university had conferred this degree. The diploma which Dr. Luckiesh received in connection with this degree bears the following citation: "Whose skillful molding of the candles of science has furnished new light for the darkened places where men live."

Dr. Luckiesh is a member of numerous societies, including the Edison Electric Institute, the Illuminating Engineering Society, The American Institute of Electrical Engineers, the American Physical Society, the Franklin Institute, the Optical Society of America, etc. He has been especially active in the Illuminating Engineering Society, having served in various capacities, such as President, Director, chairman of various committees, etc. He was awarded the Edward Longstreth Medal and certificate of merit by the Franklin Institute for his work on visibility of airplanes during the World War. It was at that time he served as Chairman of the Committee on Camouflage of the National Research Council. In 1931 Dr. Luckiesh (with Dr. Frank K. Moss) was awarded the gold medal of the Distinguished Service Foundation of Optometry.

Frank K. Moss has been associated with Dr. Luckiesh in the development of the science of seeing and is a joint author in the publication of several books and many technical papers on illumination and physiologic optics.

DR. HENRY B. PETERS

DR. HENRY B. PETERS

Dr. Henry B. Peters is the son of Dr. Thomas H. Peters, well known California optometrist. In 1938 he graduated with honors from the Optometry Department of the University of California.

Following his graduation, Dr. Peters was awarded a Research Fellowship at the University of Nebraska by the Research Foundation in Optometry. His particular research was a study of the visual aspects of the Learning Process.

After receiving his M.A., Dr. Peters joined the faculty of the Los Angeles School of Optometry, meanwhile continuing his studies at the University of California. During the summer of 1940 he was a lecturer at Claremont College. In the past year Dr. Peters has established a practice in Chico, California.

His paper on *Visual Acuity and Visual Perception* should be of great interest as he is one of the keenest students among recent graduates of Optometry.

A SUGGESTION IN THE PROFESSIONALIZATION OF AN OFFICE

There are many optometrists in the United States and the Provinces of Canada who would be eligible for Fellowship in the American Academy if they would take but one simple step. There are scores of such optometrists who have every qualification, proper undergraduate training, delightfully appointed reception rooms, marvelously fitted

examination and treatment rooms, containing all modern instrumentation. *After* entering the front door the patient can well imagine that he is in an office far removed from any commercial environment. Unfortunately, however, many patients NEVER enter the front door—they do not know about this fine office and competent doctor. Their eyes have told them that the establishment MUST be a store. WHY? Because they see the hanging neon sign, the huge lettering on the door and windows, and the display of material and posters in the windows.

Of course, there are many friends and acquaintances, both lay and professional, who DO KNOW about the doctor and his competency; they are his patients. BUT, they hesitate to recommend his services. Let me give you a true illustration. I well remember the day I opened my present office, in an office building, twenty-one years ago. My family physician came in to see me, and this is what he said, "I am delighted to come to see you in your new quarters; I have been wanting to send you many of my patients, but I *could not* as long as you were in a store." He not only sent me his patients; he recommended my services to his colleagues.

Did you ever keep a record of exactly how you obtain your patients? I can give you the names of many who have, and they were amazed to learn that nearly every new patient consulted them upon recommendation of someone. Try it, and I'll wager you will find that the very few who do come in because they saw your signs and window display will not pay for the electricity and janitor.

Another reason generally given for a store or ground floor location is, "People won't find me." This is absolutely erroneous; persons seeking you *will* find you if they know your address.

Now for the simple step! You do not have to remodel your front, although that *is* the thing to do. Simply remove your outdoor signs, re-letter your name—and ONLY your name—on the door in the size found on the doors in office buildings. Take out your window platform and inside windows, and cover the window and door inside with Venetian blinds.

Simple, isn't it? Why not do it NOW?

ACADEMY ANNOUNCEMENTS

The dates for the coming Annual Meeting in Chicago are December 7, 8, and 9, 1941, in the Hotel Morrison. Arrangements have been com

pleted in detail. The program as arranged by Fellow Hummel will be outstanding and well worth while.

There is room on the program for one or two additional papers, and the thought occurs that it might be timely to have a paper on office procedure or some examination technique not covered in our textbooks. Will you contact Chairman Hummel?

It is heartening and interesting to note that England and her possessions are carrying on as usual. During the last month we have received applications for Fellowship in the Academy from practitioners in England and British Guiana.

The Executive Council of the Academy has advised the Secretary that all Fellows of the Academy in the Army or the Navy will be exempt from dues for the duration of the war in Europe. Please send in your name if this applies to you.

PROCEDURE AND INSTRUMENTATION

by Guy L. DuPlessis

A department wherein discussions will be carried on relative to the value of various experimental and clinical techniques as employed by practicing optometrists, and also in which the instruments used by optometrists in various phases of their work, will be subjected to some critical evaluation.

SAFETY RESEARCH

The word research is frequently abused in optometric literature. An illustration of this occurs in a copyrighted article of the A.O.A. Public Health Bureau by Dr. Wm. M. Gilbert who relates the progress of the Pennsylvania State Optometric Association Highway Safety Committee. Of definite merit is their adoption of a standardized form for report to the State Highway Commission on the examination of referred motorists. However, it is safe to predict that the method of examination and its scope will not be conducive to research in its common meaning. Adequate emphasis is placed on visual acuity and perception fields. Over-emphasis is placed on primary color perception and under-emphasis is given to the fusion sense and thereby perception of speed and distance.

The difficulties of performing a "research" type of safety eye examination are admitted, but the eliminations of difficult and as yet

incomplete correlated tests prohibit the labeling of the remaining perfunctory tests as "research."

A good idea incorporated in this particular form is the description of the method used. This is desirable when tests are made by various genera of practitioners. However, in this form, no report on the method of testing fusion is required. The high percentage of abnormals is further indication that not much valuable information will be elicited unless these cases are correlated with accident proneness.

I therefore suggest that safety research be left to small well directed groups of optometrists with the enthusiastic collaboration of the rank and file, and that the projects include all tests and controls which have been found essential by previous research. In addition, other state groups, just as Pennsylvania is doing, might well interest themselves collectively in the subject of motoring safety and the physiological factors involved, not as research, but as ordinary meritorious and worthwhile enterprise.

Current Comments by Carel C. Koch

A Monthly Department

in which the Editor of the AMERICAN JOURNAL OF OPTOMETRY & ARCHIVES OF THE AMERICAN ACADEMY OF OPTOMETRY will discuss items of news of general interest; such as relate to new instruments, clinical techniques, education, public health, and optometric legislative and organization problems.

THE PRESENT STATUS OF A PUBLIC RELATIONS PROGRAM FOR OPTOMETRY

Dr. A. C. Anderson of Fort Wayne, Indiana, Editor of the INDIANA OPTOMETRIST and member of the A.O.A. Special Committee on Public Relations reviews the present position of this activity. Anderson points out that it is well known by those who have followed the developments in this field that the A.O.A. conventions at Los Angeles and at Cincinnati refused to authorize the collection and expenditure of funds for this purpose.

In order that a thorough study could be made of the whole matter, President Corbett, several months ago, issued a call for the Committee on Public Relations to meet at Atlantic City just preceding the 1941 annual convention of the A.O.A. The committee was composed

of the following: Drs. Allen C. Holland, San Diego, California, chairman; Harry E. Pine, Chicago; Walter F. Kimball, St. Joseph, Missouri; R. R. Van Kirk, Oil City, Pennsylvania; James A. Palmer, Charlotte, North Carolina; and A. C. Anderson, Fort Wayne, Indiana. Because of illness Dr. Kimball was unable to be present at the meeting. Dr. Van Kirk also was absent because of the sudden death of his father.

During the two days the committee met, sessions were held from 9:00 o'clock in the morning until 9:00 o'clock in the evening. At scheduled hours representatives of public relations firms presented their ideas of what they believed could be done to advance the interests of optometry. In general, two hours were allotted each firm for its presentation. The following firms took advantage of the opportunity offered: Carl Byoir Associates; Edward L. Bernays; Institute of Public Relations; Arnold and Jackson; Ivy Lee and T. J. Ross; Gerald D. Murphy Company; Ferris and Company; and Ames and Norr.

After hearing these representatives present their ideas of what could be done and what it would cost to do it, the committee held a private session at which the various proposals were discussed and compared and recommendations were decided upon. These were then presented to the Board of Trustees at a joint meeting of the two groups. At this meeting the various facts pertaining to this matter were thoroughly discussed and decisions made.

The tangible results of these deliberations are embodied in the following resolution, which was passed by the A.O.A. House of Delegates without opposition:

"Whereas the Public Health Bureau of the Department of National Affairs has rendered invaluable services and has proved itself indispensable not only to the other departments and agencies of the American Optometric Association but also in the furnishing of statistics and information to the various agencies of the Federal and State Government, now therefore be it

"Resolved, that the Public Health Bureau of the Department of National Affairs be continued and supported and that a Public Relations Program be inaugurated to further the work already started by the Public Health Bureau, and be it further

"Resolved, that the Trustees are hereby authorized to employ Public Relations Counsel to bring to the attention of the public of this country an increased knowledge of the advantages of Optometric service; the program to be under the direction, control, and supervision of the Board of Trustees; the scope and extent of which program shall be dependent upon funds made available for this purpose."

Quite naturally, the extent of the public relations program will be dependent upon the funds available. Anderson points out that a $25,000 program can not be put on for $8,500, which is the absolute

minimum for which any program can be inaugurated. Also, if the Board of Trustees does not get the needed funds, it can not employ a public relations counsellor to direct a public relations program. Anderson also calls our attention to the resolution which for the first time states that public health and public relations are to be treated alike and share alike in funds secured. Surely optometrists throughout the country can furnish the needed funds, if there is present a will to do so.

LONDON REFRACTION HOSPITAL APPEALS FOR HELP

Th Refraction Hospital of London is in need of assistance. Due to the war this splendid institution, originated and conducted by the optometrists of England, now needs financial assistance.

The following letter makes the appeal clear. This communication was written by W. E. Hardy, editor of THE OPTICIAN of London. The appeal should interest all American optometrists.

TO THE OPTOMETRISTS OF AMERICA:

Frankly, this is an appeal for help—from London. I should not be making it if I did not feel sure that it's an appeal to which many American optical men will want to respond.

About a mile to the southeast of London's Westminster Bridge and close to some of the south-Thames dockland districts there is an unpretentious two-story building—the first Refraction Hospital in the world.

Its doors were opened in 1923. Since then they have admitted tens of thousands of London's poor in search of better vision. And most of them have found it, thanks to the fine work of refractionists who give their services voluntarily.

Although its immediate neighborhood has suffered grievously in the air raids, and despite the fact that its premises have twice been damaged by high explosive blast, the Hospital's doors still stand open. The fine work goes on.

The Hospital's income is derived from grants and donations. It hasn't grown bigger during the past year; the calls on it haven't grown less.

I have a "hunch" that there are American optical folk who will want to lend this Hospital a helping hand through the war. Some of you already have a first-hand acquaintance with it and its staff; some of you know of the Hospital by repute. You will not need my assurance that the Hospital deserves a helping hand.

Every cent of money received by the Hospital in response to this appeal will be translated into optical service for London folk, these truly magnificent folk who have stood up to one of the grimmest episodes in the world's history. In other words, every cent will be used in a manner that cannot fail to give real satisfaction to every American optical man who sends a check.

I shall acknowledge all gifts and will let donors know from time to time how the Hospital is getting along.

In grateful anticipation,

W. E. HARDY,
Member of Committee of Management,
London Refraction Hospital.

Optometrists wishing to do so should send checks direct to Mr. W. E. Hardy, Editor, THE OPTICIAN, 72-78 Fleet Street, London, E. C., 4, England. These should be accompanied by a slip stating that the check is a donation for the London Refraction Hospital. A response will now be helpful.

NEW FACULTY APPOINTMENTS AT PENNSYLVANIA STATE COLLEGE OF OPTOMETRY

Dr. Albert Fitch, Dean of the Pennsylvania State College of Optometry, announced the following faculty appointments and changes which become effective with the start of the twenty-second annual session on Monday, September 15, 1941.

S. Winfield Smith, O.D., Director of the Public Clinics of the Pennsylvania State College of Optometry at 1809 Spring Garden Street for the past ten years, will assume charge of the Junior Clinics located in the main building on the campus at Spencer Avenue and Twelfth Street.

Julius Neumueller, B.S., O.D., for many years a member of the faculty and for the past several years Director of the Bureau of Visual Science of the *American Optical Company*, will return to the faculty as Director of the Public Clinics.

William M. Gilbert, M.S., D.Sc., O.D., who has been in charge of the Junior Clinics for the last several years, will conduct a new course in Illumination. Dr. Gilbert is a member of the Illuminating Engineering Society.

William G. Walton, O.D., of the class of 1940, has been appointed to the Clinics Staff. Jean G. Ottie, B.S., has been appointed an instructor in the Department of Bacteriology.

APPLICATION BLANK FOR FELLOWSHIP IN THE AMERICAN ACADEMY OF OPTOMETRY

Name ..... Age.....

Address..... City..... State.....

High School Name..... .....Date of Graduation.....

Graduate of College:.....Degree.....Date.....

State Board Examination:.....Date.....

Describe your office in detail *:.....

.....

Suite and Floor.....Length of practice in professional office.....

Member of optometric societies.....

Are you doing research work?.....If so, describe fully on separate sheet.....

Attach letterhead, professional card, statement, examination sheet and other printed material.

State your average examination fee: Amount, $.....

Do you have a laboratory?.....What laboratory work do you do?.....

Do you dispense your own materials?.....Do you fill prescriptions?.....

Do you have a fitting table?.....Where located?.....

Enclose $5.00 application fee and send to the office of the Secretary, 901 Lexington Building, Baltimore, Maryland. The Manual of Instruction will be sent to you for preparation of outline of case reports. (See reverse side.) The $5.00 will be retained by the Academy to cover expense of examination, providing the applicant fails to pass. Otherwise, it will be applied on the initiation fee, which is $10.00.

*** Ground floor office only acceptable when ethical dentists and physicians practice in particular locality in like manner. In event you practice in a residence or ground floor office, submit photographs of both exterior and interior. Also photographs of Signs if any are used. In the event that promotional work is done, submit samples.**

Signed.....

(Instructions to applicants upon reverse side) Date.....

AMERICAN ACADEMY OF OPTOMETRY

Instructions to Candidates

Regulations governing Academy Fellowship effective December 1, 1940, are as follows.

CLASS I.—Open to any optometrist who has been in practice more than fifteen years, and who is now practicing in an ethical and professional manner* and upon acceptance by the Board of Examiners of ten case reports from his own files concisely and completely annotated as outlined in the Manual of Instruction. To obtain "Individual Certification," the candidate may, if he so chooses, take the clinical and written examinations.

CLASS II.—Open to any optometrist who has been in practice more than five years but less than fifteen, and who is now practicing in an ethical and professional manner* and upon acceptance by the Board of Examiners of five case reports from his own files concisely and completely annotated as outlined in the Manual of Instruction, and who has taken and successfully passed a practical examination. It is to be understood that the examination given by the Board is in no way comparable to individual State Board Examinations, but is in the true sense, a screening process by which the Board of Examiners will be able to determine the ability of the candidate to successfully handle the practical problems met in general routine practice.

CLASS III.—Open to any optometrist who has been in practice less than five years, and who is now practicing in the prescribed manner* and upon acceptance by the Board of Examiners of three case reports from his own files concisely and completely annotated as outlined in the Manual of Instruction, and who has taken and successfully passed both the written and clinical examinations as outlined in the Manual.

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* Exclusive office practice — no display of price, merchandise, or advertising. Ground floor office accepted only where ethical physicians and dentists practice in that locality in like manner. In event you practice in a residence or ground floor office submit photographs.

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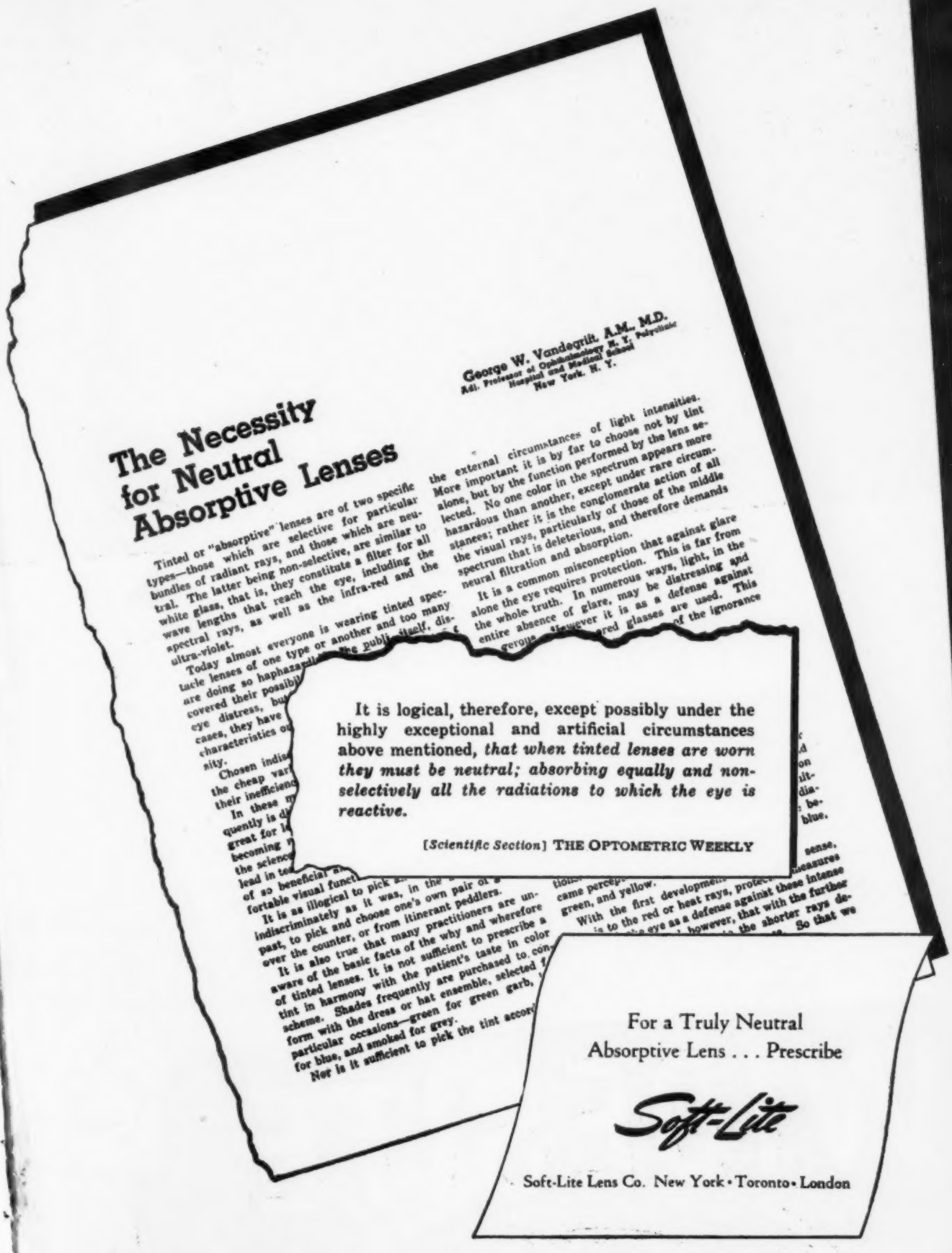

The Necessity for Neutral Absorptive Lenses

George W. Vandegrift, A.M., M.D.
Adj. Professor of Ophthalmology, N. Y. Polyclinic Hospital and Medical School
New York, N. Y.

Tinted or "absorptive" lenses are of two specific types—those which are selective for particular bundles of radiant rays, and those which are neutral. The latter being non-selective, are similar to white glass, that is, they constitute a filter for all wave lengths that reach the eye, including the spectral rays, as well as the infra-red and the ultra-violet.

Today almost everyone is wearing tinted spectacle lenses of one type or another and too many are doing so haphazardly. The public itself, discovered their possibilities for relief of eye distress, but in many cases, they have characteristics of

sity.

Chosen indiscriminately as the cheap variety their inefficiency. In these quently is great for becoming the science lead in of so beneficial fortable visual

It is as illogical to pick indiscriminately as it was, in the past, to pick and choose one's own pair of over the counter, or from itinerant peddlers.

It is also true that many practitioners are unaware of the basic facts of the why and wherefore of tinted lenses. It is not sufficient to prescribe a tint in harmony with the patient's taste in color scheme. Shades frequently are purchased to conform with the dress or hat ensemble, selected for particular occasions—green for green garb, for blue, and smoked for grey.

Nor is it sufficient to pick the tint according to the external circumstances of light intensities. More important it is by far to choose not by tint alone, but by the function performed by the lens selected. No one color in the spectrum appears more hazardous than another, except under rare circumstances; rather it is the conglomerate action of all the visual rays, particularly of those of the middle spectrum that is deleterious, and therefore demands neural filtration and absorption.

It is a common misconception that against glare alone the eye requires protection. This is far from the whole truth. In numerous ways, light, in the entire absence of glare, may be distressing and perhaps dangerous. However it is as a defense against glare that tinted glasses are used. This

It is logical, therefore, except possibly under the highly exceptional and artificial circumstances above mentioned, *that when tinted lenses are worn they must be neutral; absorbing equally and non-selectively all the radiations to which the eye is reactive.*

[*Scientific Section*] THE OPTOMETRIC WEEKLY

came perceptible.

green, and yellow.

With the first development

is to the red or heat rays, protective

the eye as a defense against these intense

however, that with the further

the shorter rays de-

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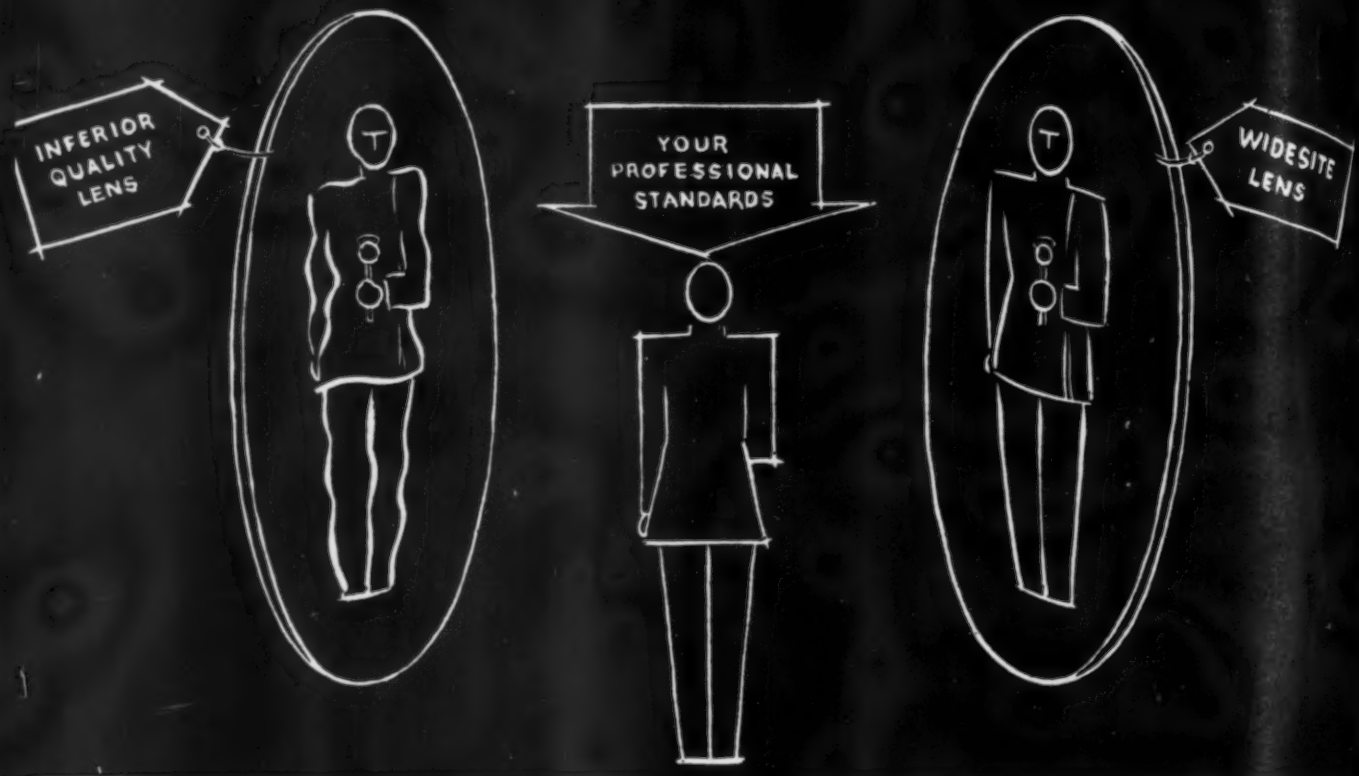

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